Br Heart J 1992;67:106–16

BRITISH CARDIOLOGY

Provision of services for the diagnosis and treatment of heart disease

Fourth Report of a Joint Cardiology Committee of the Royal College of Physicians of London and the Royal College of Surgeons of England

Abstract

The principal conclusions of the fourth report of the Joint Cardiology Committee are:

1 Cardiovascular disease remains a major cause of death and morbidity in the population and of utilisation of medical services.

2 Reduction in the risk of cardiovascular disease is feasible, and better co-ordination is required of strategies most likely to be effective.

3 Pre-hospital care of cardiac emergencies, in particular the provision of facilities for defibrillation, should continue to be developed.

4 There remains a large shortfall in provision of cardiological services with almost one in five district hospitals in England and Wales having no physician with the appropriate training. Few of the larger districts have two cardiologists to meet the recommendation for populations of over 250 000. One hundred and fifty extra consultant posts (in both district and regional centres) together with adequate supporting staff and facilities are urgently needed to provide modest cover for existing requirements.

5 The provision of coronary bypass grafting has expanded since 1985, but few regions have fulfilled the unambitious objectives stated in the Third Joint Cardiology Report.

6 The development of coronary angioplasty has been slow and haphazard. All regional centres should have at least two cardiologists trained in coronary angioplasty and there should be a designated budget. Surgical cover is still required for most procedures and is best provided on site.

7 Advances in the management of arrhythmias, including the use of specialised pacemakers, implantable defibrillators, and percutaneous or surgical ablation of parts of the cardiac conducting system have resulted in great benefit to patients. Planned development of the emerging sub-speciality of arrhythmology is required.

8 Strategies must be developed to limit the increased exposure of cardiologists to ionising radiation which will result from the expansion and increasing complexity of interventional procedures.

9 Supra-regional funding for infant cardiac surgery and transplantation has been successful and should be continued.

10 Despite advances in non-invasive diagnosis of congenital heart disease the amount of cardiac catheterisation of children has risen due to the increase in number of interventional procedures. Vacant consultant posts in paediatric cardiology and the need for an increase in the number of such posts cannot be filled from existing senior registrar posts. All paediatric cardiac units should have a senior registrar and in the meantime it may be necessary to make proleptic appointments to consultant posts with arrangements for the appointees to complete their training.

11 Provision of care for the increasing number of adolescent and adult survivors of complex congenital heart disease is urgently required. The management of these patients is specialised, and the committee recommends that it should ultimately be undertaken by either adult or paediatric cardiologists with appropriate additional training working in supra-regionally funded centres alongside specially trained surgeons.

12 Cardiac rehabilitation should be available to all patients in the United Kingdom.

13 New recommendations for training in cardiology are for a total of at least five years in the specialty after general professional training, plus a year as senior registrar in general medicine. An additional year may be required for those wishing to work in interventional cardiology and adequate provision must be made for those with an academic interest.

14 It is essential that both basic and clinical research is carried out in cardiac centres but these activities are becoming increasingly limited by the lack of properly funded posts in the basic sciences and restriction in the number of honorary posts for clinical research workers.

15 A joint audit committee of the Royal College of Physicians and the British Cardiac Society has been established to

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Accepted for publication 23 September 1991

coordinate audit in the specialty. All district and regional cardiac centres should cooperate with the work of the committee, in addition to their participation in local audit activities.

1 Introduction

1.1 The third report of the Joint Cardiology Committee of the Royal College of Physicians of London and the Royal College of Surgeons of England (1985) anticipated several imminent developments in the diagnosis and treatment of heart disease and recommended a further review within five years.[1]

1.2 In preparing this fourth report the committee sought to assess the extent to which the recommendations of 1985 have been realised and to discuss present and future needs in the light of that progress and the projected burden of heart disease in the United Kingdom over the next decade.

1.3 The overall assessment is one of, at best, hesitant progress towards implementation of the earlier objectives. The crucial role of the cardiologist practising in the district general hospital was widely acknowledged even before the time of the third report, but gross underprovision of cardiological services continues to exist in many parts of the country. Within the regional specialist centres the use of coronary angioplasty and other interventional procedures has expanded, though more slowly than in mainland European countries and North America. The provision of coronary artery surgery has also failed to achieve the unambitious 1985 minimum targets in all but a few regions. Of other "high technology" developments anticipated in 1986 prenatal diagnosis of congenital heart disease has continued to evolve and magnetic resonance imaging has fulfilled much of its promise but remains confined to a few centres. An anticipated requirement for intracoronary thrombolysis has been overtaken by demonstration of the practical superiority of intravenous therapy. Major new developments are required to care for the increasing number of adults with partially corrected or uncorrectable congenital heart disease and to exploit recent advances in the treatment of arrhythmias.

2 Scale of the problem

2.1 Well over a quarter of a million people die every year from diseases of the circulatory system in England and Wales. These diseases are the most frequent cause of death in both sexes and account for approximately half of all deaths. Cardiovascular diseases account for 26% of all years of working life lost in men (to age 65) and 15% of those lost in women.[2]

2.2 The major cause is coronary heart disease which accounts for 65% of cardiovascular deaths in men and 49% in women.[3] About one in 200 men die of coronary heart disease before the age of 45 and this increases to one in 11 men before the age of 65. For women up to the age of 65 coronary heart disease claims the lives of about one in 40. These rates are among the highest in the world, and though they reflect a fall since 1978 they remain 50% above the 1950 level.[4] The United Kingdom has yet to experience the large general decline in deaths from coronary heart disease which North America and several European countries have been enjoying for some years. A major logistical problem hindering the effective delivery of aid relates to the time and place of these deaths: about half are sudden and most occur within the home. Although all areas of the United Kingdom have high levels of coronary heart disease, wide differences exist between regions and social classes: Glasgow has twice the death rate of some parts of London and within each region higher death rates are associated with manual workers and the lower paid.

The principal burden on the cardiological services, however, is imposed by the high prevalence of coronary heart disease in the community. The British Regional Heart Study showed that in the early 1970s 25% of men aged 40–59 had some evidence of coronary heart disease.[5,6] In the Welsh Heart Health Survey of 1985 18% of men and 11% of women aged 55–64 had a history of myocardial infarction, and/or symptoms of angina, and/or electrocardiographic changes of myocardial infarction.[7] If these prevalence rates applied to the whole United Kingdom population some two million people under the age of 64 would have evidence of coronary heart disease. While much of this disease may be clinically unrecognised, it was estimated that in 1984 ischaemic heart disease was responsible for 2·43 million bed days in English hospitals.[8]

2.3 Chronic rheumatic heart disease is now an infrequent cause of death and morbidity in Britain, but degenerative valve disease remains an important cause of hospital admission for treatment of heart failure and for surgery; the number of affected patients is likely to rise with the increasing number of elderly people in the population. Studies of general practice and hospital admissions in London found that the prevalence of heart failure in the community rose from six per 10 000 under the age of 65 to 280 per 10 000 over 65. Coronary artery disease was the predominant aetiology with valve disease reponsible for 13% of cases and hypertension (6%), cor pulmonale (3%), and congenital heart disease (2%) as other identifiable causes. Underuse of diagnostic procedures resulted in a significant proportion of cases (37%) in which an aetiology could not be accurately established.[9]

2.4 Deaths in infancy and childhood from congenital heart disease have also declined, chiefly because of the benefits of medical treatment and surgery. The birth rate in the United Kingdom has been static over the last four years, according to Department of Health figures. Since the incidence of congenital heart disease (eight per 1000 live births)[10] is unchanged, there is no evidence of naturally declining numbers to account for the reduction in deaths. Many adolescent and adult survivors of congenital heart disease, however, require specialised follow up and make heavy demands on the hospital services (see 8).

3 Prevention

3.1 Abundant evidence testifies to the importance of environmental factors in the genesis of cardiovascular disease. This has been derived from international and within country comparisons, the effects of migration, and community intervention projects. The concept that risk can be reduced by appropriate modifications of life style is therefore realistic and supported by recent controlled trials.[11] We recognise that achievements in this area have sometimes been disappointing. We do not doubt, however, that improved identification of strategies that may be potentially successful and more urgent emphasis on those that are most firmly established can have an important impact.

3.2 The recommendations published in 1987 by the British Cardiac Society[12] form a useful basis for action by doctors with a special interest in and responsibility for the control of heart disease. Government leadership, however, is essential: as yet no strategy for coronary prevention has been developed and action has been piecemeal. Many government and European Community policies run counter to coronary risk reduction and the achievement of good health.[4] Contributions from the regional and district health authorities and the education services have been slow to develop. These deficiencies need to be addressed.

3.3 The British public continues to consume excessive quantities of fat, especially saturated fat. This should be reduced, with approximately equivalent quantities of saturated, monounsaturated, and polyunsaturated fat being eaten. Physicians in general and cardiologists in particular should encourage dietary change of this kind. Cholesterol measurement is of value in identifying some people at high risk who may benefit from special dietary regimens or drug therapy. Cholesterol testing should be directed to those with a family history of premature coronary disease or with clinical features of hyperlipidaemia, those with manifest coronary disease (especially after bypass grafting or angioplasty), those under treatment for diabetes and high blood pressure, and those with a long history of heavy smoking.[13]

3.4 Blood pressure screening is already commonplace in general practice and occupational health services, and its importance has been stressed in the recent government white paper on the reorganisation of the National Health Service.[14,15] The beneficial effects of the lowering of raised blood pressure by drug therapy on the incidence of stroke and cardiac failure are undoubted. There may also be a significant although smaller reduction in the incidence of coronary heart disease.[16]

3.5 Strenuous efforts should be made to counter the harmful effects of smoking on cardiovascular health. It is the single most important risk factor for coronary heart disease and one that is self inflicted and entirely preventable.[17] The government is in a unique position to reduce cigarette smoking by imposition of higher tax, tougher restriction of advertising and sponsorship by tobacco companies, and designation of funds for education.

4 Pre-hospital treatment of cardiac emergencies

4.1 In Britain approximately two thirds of deaths from coronary heart disease occur outside hospital, often within one hour of the onset of symptoms and usually from ventricular fibrillation.[18] Many lives could be saved every year if the urgency of prompt care were widely appreciated. The advent of thrombolysis has further increased the need for early medical intervention in patients with acute myocardial infarction.

4.2 Equipment for and expertise in defibrillation should be available outside hospital, particularly in areas such as sports stadiums and airports where large numbers of people are likely to assemble.[19] It can be provided by general practitioners, but in many areas will be delivered most effectively by ambulance personnel who should ideally also have training in airway control, intravenous infusion, and the use of cardioactive drugs. In the short term, ambulance staff and first aid workers with basic training can be instructed within a few hours in the use of advisory defibrillators and can save life.[20] The key to successful defibrillation is a short response time and this should be the major factor in determining the best system for a particular area. Basic cardiopulmonary resuscitation before the arrival of a defibrillator improves survival and the general public should be trained in accordance with Resuscitation Council guidelines.[21] But the success of out-of-hospital resuscitation from cardiac arrest will be negligible if rapid defibrillation is not available. A recent government initiative encouraging the availability of defibrillators in all front-line ambulances is welcome.

4.3 The value of pre-hospital thrombolysis in suspected acute myocardial infarction is unproven but may be clarified by current trials. General practitioners with appropriate expertise who wish to take responsibility for the administration of thrombolytic agents should be supported, especially if they work at a distance from a general hospital, but they must be able to confirm the diagnosis electrocardiographically.

5 The district hospital

CONSULTANT STAFF

5.1 Much of the heart disease in the United Kingdom will present to a cardiologist in a district general hospital who usually has a commitment to the provision of general medical care. Ischaemic heart disease presents the greatest proportion in terms of workload and use of resources, and the district cardiologist has a central role both in prevention and treatment. The increasing awareness and expectations of the public which were noted in the 1985 report continue. In particular, the need—often inadequately met—for intervention in coronary artery and valve diseases has placed mounting pressure on the district cardiologists who are responsible for the initial evaluation. The introduction of coronary thrombolysis has increased the need for skilled

evaluation and careful follow up of patients after acute myocardial infarction. The increase in workload, both in scope and in complexity, of the district cardiologist limits the time for more general medical commitments of the appointment. Sessions at the regional cardiac centre can offer advantages that include improved liaison, better upgrading of specialised knowledge and practical skills, continuity of care, and collaboration in follow up after surgery or pacemaker implantation. A divided commitment may, however, be difficult to achieve and should not be undertaken at the expense of the principal responsibilities in the district general hospital.

5.2 A realistic appraisal of the needs of a district hospital, made over three years ago, suggested a requirement for two cardiologists per 250 000 population.[22] It is unfortunate that we are scarcely any closer to this goal than at the time of the last report: of 83 hospitals in this category only 37 have two cardiologists. Indeed even in 1990 no less than 41 of 212 district hospitals in England and Wales lacked any physician with specialised training in cardiology. This deficiency is not confined to smaller health districts.

5.3 The committee reiterates its recommendation (*a*) that fully funded posts in cardiology with adequate facilities are developed in all district hospitals that lack one and (*b*) that urgent consideration be given to the need for two consultant cardiologists in those districts where the population exceeds 250 000 with greatest priority for parts of the country with higher levels of morbidity and mortality from heart disease. The target, however, remains the provision of one cardiologist per 125 000 population. This has long been exceeded in most other western European countries.

5.4 An estimate of the total shortfall in posts (including both district hospitals and centres) agreed by the Manpower Committee of the Royal College of Physicians is 150. Even with this major addition to staffing levels the United Kingdom will still have fewer than 10 posts per million population compared with approximately 45 per million for the rest of Europe.[23]

JUNIOR STAFF

5.5 It is usual for the district cardiologist to have either a registrar or a senior house officer who may be part of a general medical rotation. The more junior doctor will usually be completing general professional training rather than starting a career in cardiology and thus the opportunity to receive more than a superficial training in non-invasive cardiology is limited. In these circumstances the trainee will not be able to contribute fully to the work of the department. This necessarily implies a substantial consultant involvement at all levels of the service although the use of clinical assistant sessions may be a valuable means of providing continuity. The use of the staff grade for certain types of work such as exercise testing may also ease the workload, but this strategy should not deflect attention from the need for more consultant posts.

SUPPORTING STAFF

5.6 Adequate provision of physiological measurement technicians and cardiographers must be made to deal with the needs of routine electrocardiography, ambulatory electrocardiographic monitoring, stress testing, echocardiography, pacemaker implantation where performed, and pacemaker clinics. A figure of seven cardiological physiological measurement technicians per 250 000 population is recommended.[22] The work of cardiological technicians may be integrated with that of other departments in which case additional staffing will be required.

CARDIAC CARE UNIT

5.7 There should be a dedicated cardiac care unit in all district hospitals, with 6–8 monitored beds for the average sized district with a population of 250 000, depending mainly upon the burden of coronary heart disease within the catchment area. The role of the cardiac care unit has expanded and may include the care of any sick cardiac patient requiring continuous monitoring of heart rhythm or haemodynamic variables. The unit should be supervised by the cardiologists who will be responsible for operational policy in agreement with colleagues. There should be facilities for insertion of emergency pacemakers and invasive pressure monitoring; this need implies the availability of image intensification within the unit.

We consider these facilities are necessary for the appropriate designation of a ward area as a cardiac care unit. The availability of monitored beds does not in itself justify this designation.

PROGRESSIVE CARE

5.8 After discharge from the cardiac care unit there are advantages for the patient being moved to a contiguous, progressive care environment. This enhances continuity of care, provides opportunity for extended monitoring (that is, telemetry) for high risk patients, and is helpful both in rehabilitation and teaching. Disadvantages relate mainly to non-involved medical wards which may experience a reduction in the range of their acute care case mix. Provision must be adapted to local circumstances and needs.

6 Regional cardiac centres

STRUCTURE

6.1 The major cardiac centres are staffed by an integrated team of medical, nursing, and technical staff who jointly provide a comprehensive diagnostic and therapeutic service usually to a population of around 1·5–2 million. The limiting factor in the provision of care is the ability to provide an adequate number of surgical procedures for the community served, particularly coronary artery bypass grafts (CABG). The third joint colleges report estimated an annual requirement of 400 to 500 coronary artery bypass grafts or angioplasties per million of the population. A recent study suggests that this figure should apply to coronary artery bypass grafts, with a need for angioplasty in addition[24] (see 6.4). The range reflects

differences in the prevalence of coronary artery disease in different parts of the country, which depend both on the incidence of the disease and the age structure of the population. Whereas some clinicians believe this range is an underestimate of need, in practice even this is rarely achieved. A further move towards the target should result in regional centres undertaking up to 1000 coronary bypass procedures annually with surgery for valvar and congenital heart disease in addition. There is no optimum size for cardiac units but the dangers of too large an institution providing "conveyor belt medicine", with a loss of the personal touch, is a potential disadvantage for patients. In some cases it may be preferable to open a second unit in a more populous region rather than risk this development.

SURGICAL SERVICE

6.2 The regional unit serving 1·5–2 million people whould be able to provide between 800 and 1200 operative procedures each year. This workload requires three or four consultant surgeons, a senior registrar, at least two registrars, plus an appropriate senior house officer complement of at least four. The consultant grade in cardiothoracic surgery is expanding at approximately 3% per annum and maintenance of training grade numbers is of critical importance to ensure a steady supply of well trained cardiac surgeons both to complement this expansion and to fill retirement vacancies. Here, it is going to be essential to provide the Joint Planning Advisory Committee with well argued and updated advice on appropriate numbers of senior registrars and registrars to meet the expected expansion in consultant posts. In units with a paediatric cardiac surgical programme additional consultant numbers will be needed and two of the consultants should have had special training in paediatric cardiac surgery and have responsiblity for this aspect of the work.

The number of consultant anaesthetists involved in cardiac surgical programmes varies from one unit to another but a strong case can be made for matching the number of consultant cardiac surgeons with an equal number of consultant anaesthetists and an appropriate number of trainees. This recommendation takes into account and acknowledges the important role of the anaesthetist in preoperative assessment (including necessary involvement in the cardiac catheter laboratory), the lengthy nature of many of the operations, and involvement in postoperative care. It is important that at least two consultant anaesthetists should be able to regard their involvement with the cardiac surgical programme as their prime responsibility, and this is especially so in regard to paediatric cardiac anaesthesia. The role of the anaesthetic staff in the organisation and conduct of patient care in the intensive care unit also varies from one unit to another, but the increasing importance of the anaesthetist in this area needs emphasis, whether overall command of the intensive care unit remains a surgical or a joint responsibility. The successful running of a happy and effective intensive care unit depends upon close cooperation between surgeon, anaesthetist, cardiologist, and nursing staff, and while each unit has to determine its own working practices, a chain of command agreed between the surgical and anaesthetic staff at all levels is imperative. If the intensive care unit is run by an "intensivist", it is necessary to ensure that junior surgical and anaesthetic staff receive appropriate training in this discipline in the same way as would happen if the unit were run either by a surgeon or an anaesthetist or as a joint undertaking.

The cardiac surgical programme has to be supported by a team of perfusionists. For a programme of 1000 cases per year there need to be four qualified perfusionists and one or two in training. The important role of other supporting staff including personal secretaries and operating department assistants should be recognised and proper remuneration provided.

The use of non-medically qualified operating assistants, as widely practised in North America, is currently under review in the form of a pilot study in the United Kingdom. This is seen as a development that could be important in view of the continuing restrictions imposed on the junior staff establishments in most units and of the need to provide surgeons in training with a balanced programme.

The facilities should include the dedicated use of two operating theatres and occasional access to a third. If interference with other surgical disciplines and intermittent interruption of the surgical programme is to be avoided there must be 10 or 12 dedicated intensive care unit beds available, together with an appropriate number of general ward beds to ensure progressive patient care.

With some elective, particularly coronary artery, surgery it may be possible for units to develop a recovery system for selected postoperative patients short of full intensive care. Some have already done so. This can help to relieve some of the pressure on beds in the intensive care unit but such recovery units have to be well organised with appropriate staff and supervision if standards of after care and the safety of the patient are to be protected.

The problem in recruiting and retraining nursing staff also needs emphasis. Rotation through the various departments of a cardiac unit to encourage the development of a pool of experienced staff familiar with all aspects of care for the cardiac patient can optimise their deployment. Wherever possible unification of nursing command should be encouraged and fragmentation of the nursing budget avoided. Measures such as these are seen to be essential if serious impairment of cardiac services, due to future predictable reduction in numbers of nurses, is to be avoided.

MEDICAL SERVICE

6.3 Approximately twice the number of cardiac catheterisation procedures is required to provide diagnostic support for a given number of patients destined for surgery. An effectively run cardiac catheterisation laboratory is capable of investigating 1000 patients per annum,

but angioplasty is more time consuming. A major centre therefore needs at least two such laboratories. The size of the investigative facility within the unit will depend among other things on the number of permanent pacemakers implanted. Where this is substantial, an additional suite dedicated to pacing and electrophysiological studies is an effective and economical alternative to the use of a fully equipped catheter laboratory.

Adequate beds should be provided both for investigation of patients and for the care of those admitted with cardiological problems. The beds required for cardiac catheterisation will vary with the proportion of patients investigated as day cases. This is steadily increasing and is to be encouraged but will be influenced by geographical considerations.

Previous reports have emphasised the need for adequate cardiological staffing at consultant grade. We endorse earlier recommendations for a complement of two cardiologists for every cardiac surgeon, which implies a minimum of six for the smallest unit and at least eight in the ideal major regional unit. The expansion of interventional cardiology, notably coronary angioplasty, together with increasing awareness of the hazards of excessive exposure to radiation may dictate the need for even larger numbers. Adjustments might be appropriate if a radiologist or visiting cardiologist is involved in diagnostic and interventional procedures. The cooperation of a cardiologist, however, is strongly recommended for radiologists to undertake coronary angioplasty or balloon dilatation of valves.

As the scope and workload in cardiology increases as much clinical practice as possible should be transferred to the district general hospital. Permanent pacemaking can appropriately be undertaken in district general hospitals provided facilities and expertise are adequate and that cover can be made available if a single-handed cardiologist is absent from the unit. This frees valuable facilities in the major units and is more convenient for patients and professionally rewarding to the district cardiologists.

CORONARY ANGIOPLASTY

6.4 Considerable development in percutaneous transluminal coronary angioplasty (PTCA) has occurred since the previous report. The original indication—resistant angina produced by a discrete single vessel stenosis—has been expanded, and many patients with multivessel and multilesion disease can be treated successfully by PTCA. The technique has a significant role in the management of patients with unstable angina, those with continuing ischaemia after myocardial infarction, and patients who have already had coronary bypass grafts.

PTCA is usually well tolerated, entailing about two to three days in hospital and a quick return to full activity. The risks are low and would be falling but for the widening indications that result in greater hazard from multivessel disease and poor myocardial function. The small mortality—0·4% for single vessel disease in the United Kingdom[25]—is largely related to acute occlusion of the artery during or shortly after the procedure. The immediate success rate for relief of stenoses should be about 90%; that for chronic occlusions is lower. Restenosis occurs to a degree that calls for a further procedure within six months in about 20% of patients: repeat angioplasty may be performed with a similar risk of restenosis.

The total need for angioplasty in the United Kingdom is hard to define, partly because the indications for the procedure are evolving. It should be seen as complementary to coronary artery bypass grafting (CABG) and not only as an alternative form of therapy. In most western European countries the number of angioplasties is at least 50% of the number of CABG operations; this indicates an immediate need for 300 angioplasties per million of the population in the United Kingdom. With constraints imposed by limited funding and a shortage of trained operators only 127 procedures per million of the population were performed in 1989.[25] Provision of PTCA must be placed on the same formal footing as coronary surgery with a designated budget and planning of facilities. Cardiac centres should have at least two consultant cardiologists or radiologists trained in angioplasty so that acute procedures can be carried out and other doctors trained for the necessary expansion in numbers.

Surgical cover is required unless surgical intervention would be inappropriate. Immediate coronary grafting is required in about 2% of procedures in order to deal with acute occlusion of large coronary arteries. The time within which an operating theatre should be available will vary with the nature of the case. Surgical cover should normally be provided by an operating theatre in the same building and future developments should be planned on this basis. It may be feasible, however, as an interim measure, to use another building or nearby hospital if rapid transfer can be achieved. Arrangements for cardiac surgery inevitably take a short time and transfer should not be a limiting factor that puts the patient at further risk.

SPECIALISED ARRHYTHMIA SERVICES

6.5 Though rhythm disorders may require no treatment or only simple treatment, many call for special expertise for assessment and management. The scope for the successful relief of symptoms or for improvement in prognosis in patients with refractory or dangerous arrhythmias has widened since the publication of the third joint colleges report. Arrhythmology has developed as an important subspecialty of cardiology, calling for skills in electrophysiology, special purpose pacemakers, catheter ablation of elements of the conducting system, and the use of implantable defibrillators. The arrhythmologist must also work closely with surgeons who have a similar specialised interest because the preferred treatment for some patients will be surgical, and both physicians and surgeons must be involved with implantation of defibrillators. These activities are complex, requiring the use of

specialised equipment and the support of trained technical staff, and are justified by the striking results. The commitment required for the provision of a specialised arrhythmia service should not be underestimated because investigation is time consuming and can be accommodated only where facilities for catheterisation are adequate. In terms of surgery, we believe that up to 30 operations per million population per annum is a reasonable estimate for the next decade and that present planning of centres should be made on this basis. Whether this figure proves to be appropriate depends on the assessment of the merits of surgical and other methods as the subspeciality develops.

The committee recommends that every effort be made to make these new and successful treatments more widely available.

X RAY SAFETY FOR CARDIAC PROCEDURES

6.6 The development of coronary angioplasty has re-emphasised the importance of effective radiation protection. The *Ionising Radiations Regulations 1985* cover the safety standards for the protection of public and workers. They state the dose limits and include the requirements for monitoring radiation and the appointment of medical physicists who are trained as radiation protection advisers and supervisors. Each employer (that is, the health authority) has a statutory duty to ensure compliance with the regulations. In practice the responsibility usually lies with the district general manager; radiation protection advisers must be employed both to advise on regulations and to review protective measures within hospitals. The health authority is required to appoint, in writing, one or more advisors as radiation protection supervisors to ensure that work is carried out in accordance with the regulations.

Staff working with *x* rays must be monitored to ensure that their doses are as low as reasonably practicable, particularly as the statutory dose limits are under constant review. Doses to patients need to be monitored periodically to ensure that they are also as low as practical and are within the guidelines of the *Ionising Radiation (protection of persons undergoing medical examination or treatment) Regulations 1988.* Protection measures required in hospitals include the provision of adequate shielding. Consequently any plans for new developments should be discussed with the radiation protection adviser at an early stage.

7 Supra-regional specialties

A supra-regional speciality is defined as a clinical activity of such complexity or limited application that the service itself cannot justifiably be provided by every region in the country. The Department of Health has agreed to provide top slice funding for a maximum of nine supra-regional units in any given discipline. Because there are fifteen health regions in England and Wales it is thought that if the figure of nine is exceeded then the clinical service involved should rightly become a regional responsibility and not receive preferential funding.

TRANSPLANTATION

7.1 A steady growth in transplantation surgery has occurred since the time of the last joint college report: the number of units recognised and funded supra-regionally for this work has increased. A balance needs to be struck between the aspirations of units not currently undertaking transplantation that wish to do so, the supra-regional funding concept, and the supply of donor organs.

To date, the controlled development of heart and heart/lung transplantation in designated centres has been successful and, although it may be desirable to see transplantation develop into a regional responsibility, for the time being it would seem reasonable to continue to limit the number of centres.

NEONATAL AND INFANT CARDIAC SURGERY

7.2 It is important that the supra-regional concept should continue to apply to units concerned with surgery for congenital heart disease in infants and neonates. Periodic review of units undertaking this type of work is necessary to ensure that designation is appropriate and that both the volume and standard of work being carried out justifies continued supra-regional funding.

8 Paediatric cardiology

8.1 Since the 1979 report of the British Paediatric Association Working Party on Cardiac Services for Children in England and Wales[26] and the two reports of the Joint Cardiology Committee of the Royal College of Physicians and Surgeons,[1 27] the sub-specialty of paediatric cardiology has changed and expanded considerably. As a result of a crisis in staffing in paediatric cardiological units in 1987 (two new consultant posts and two existing posts at that time were not filled because of lack of suitably trained applicants), the Royal College of Physicians and the British Cardiac Society set up a Joint Working Party to examine the causes of the problem and to make recommendations for the future. This working party has completed a report on which the following paragraphs are based.[28] Recognising that some of the problems lay in the training of doctors for consultant posts, a new schedule of training was constructed.

8.2 Ten new posts and a further 11 replacement appointments due to retirement or resignation will have to be made by the end of the century. The existing shortfall will continue because the six existing senior registrar positions are unlikely to cope with the necessary replacements. There is no way to solve the immediate problem by planning, but health authorities should be encouraged to make proleptic appointments and to send suitable candidates to complete their training before taking up full-time employment.

8.3 Since 1980 the specialty has expanded to 48 full-time consultants and diversified in its activities. Prenatal cardiology is now part of the work of a paediatric cardiologist; only the practising paediatric cardiologist is able to advise the obstetrician and the parents of the unborn child as to prognosis for the fetus with

congenital heart disease. The new technique of fetal echocardiography is difficult and very time consuming.

8.4 Cardiac catheterisation of congenital heart disease was expected to diminish with the advent of sophisticated non-invasive techniques such as cardiac ultrasound and magnetic resonance imaging. Although many congenital malformations are now treated medically or surgically without invasive investigation, the amount of catheterisation has not fallen—indeed, it has increased. This is undoubtedly owing to a rise in the number of interventional procedures including angioplasty; balloon dilatation of valves; transluminal plugging of ducts, collateral arteries, and shunts; and more recently the closure of septal defects.

8.5 With the centralisation of congenital heart disease management in regional centres, affected children may have to travel long distances for their follow up and treatment. Paediatric cardiologists in supra-regional centres attend peripheral clinics throughout their catchment areas on at least one day a week.

8.6 All existing mainland centres whether offically designated supra-regional or regional that offer paediatric cardiological services serve a minimum population of three million people. Some of the larger centres serve very large populations of five to six million. The committee recommends that one consultant paediatric cardiologist per million of the population should be aimed for in the near future. This in effect means that no unit will have less than three consultants, very much in line with the general recommendations of the Department of Health for more junior grades, and particularly important in a consultant orientated specialty. This recommendation would result in the number of consultants in the United Kingdom rising from 48 to about 60 to cope with the present and future workload. This increase cannot be filled from existing senior registrar posts and the committee recommends that every supra-regional centre should have a senior registrar training post—an increase of between three and five such positions.

8.7 Improvements in surgical and medical treatment of congenital heart disease have resulted in considerable numbers of patients surviving into adolescence and adult life. Many require special management throughout the remainder of their life and supervision of some lesions may be required for 50–60 years. Patients must be treated by cardiologists trained in the appropriate techniques and appointed to strategic centres throughout the country. A solution would be to train adult cardiologists in congenital heart disease and, in association with paediatric cardiologists, to set up supra-regional centres for the ultimate management linked to regional care (supervision) clinics, as has been established for paediatric cardiology.

8 Adolescent/adult congenital heart disease

9.1 Probably 60–70% of patients treated for congenital heart disease in infancy and childhood reach adult life. The experience at the National Heart Hospital, which has provided special facilities for treating adolescents and adults with congenital heart disease since 1976, shows a change in the reasons for admission and increasing age of patients. In the past four years the inpatient requirements of patients aged 20–30 years have exceeded those of the adolescents, as did those of the over 30s in 1989. Patients with more complex malformations are now surviving beyond childhood to present difficult problems for the cardiologist. Acquired coronary artery disease and hypertension are beginning to present problems added to those of the underlying congenital heart disease. Approximately 50–60% of long term survivors have a problem that requires cardiac and/or cardiac surgical advice and treatment. There are increasing cardiac surgical requirements for congenital heart disease with the expanding need for reoperation of the first definitive repair. The need for such reoperations continues to the fourth decade and provision will be required for the long term survivors who require surgery for acquired coronary artery disease.

9.2 Increasing outpatient consultations related to the underlying heart disease are needed for advice on topics such as contraception and pregnancy, employment, insurance, driving licences, extracardiac surgery, psychosocial problems, housing, and even prison sentences and necessitate a structured organisation. An integrated fetal scanning service is necessary since this group has a higher than normal risk of fetal abnormality.

9.3 The optimal care of these patients, particularly those with complex disease, should be centralised in four or five centres with the specialised technology and necessary cardiological and cardiac surgical skills. The main demands, besides adult inpatient facilities, are for diagnostic magnetic resonance imaging; echocardiography (including transoesophageal echocardiography); arrhythmia and failure management; and properly timed investigation, intervention, and reoperation. At the moment relatively few doctors have the experience and skills to provide care throughout this wide age range in what is a new and changing clinical practice. Attention must be directed to the provision of appropriately trained clinicians. In the immediate future the staffing of departments that provide care for adults with congenital heart disease will vary; some will have adult cardiologists specifically trained in the subject while others will rely heavily on paediatric cardiologists who continue the care of their patients into adult life, frequently with the cooperation of an adult cardiologist. The important issue is the delivery of high quality care to the patient rather than the exact designation of those involved.

9.4 Arrangements for the care of these patients must be flexible and integrated. Some paediatric cardiologists have the training and interest but no beds or facilities or adequate training in management of acquired degenerative cardiovascular diseases. The involvement of paediatric cardiologists will be

essential during the period of establishing optimum centralised care. Most patients are referred to local cardiologists, but ultimately care should be by specially trained cardiologists in appropriately equipped centres. Those requiring further surgery or with complex lesions needing particular advice should have the opportunity of reaching supra-regional centres, which will require supra-regional funding.

10 Cardiac services for the elderly

10.1 By the year 2020 it is expected that one in five of the population will be at least 65 years old. Age alone should not exclude patients from potentially useful treatment. The value of coronary thrombolysis, pacing, and coronary angioplasty are well established in this age group. The use of cardiac surgery, with the exception of transplantation, has also increased in older patients. Changing demography and developments in cardiology will need to be considered in planning services for the future.[29]

11 Cardiac rehabilitation

11.1 Rehabilitation after myocardial infarction or coronary artery surgery is widely practised in North America, Europe, and Australia. After programmes began in the early 1970s the development of cardiac rehabilitation in Great Britain and Ireland has been slow, but a growing number of programmes have been established in the past five years. Nevertheless, a survey carried out in 1989 by the Coronary Prevention Group showed that of the 210 health districts in England and Wales only 119 had cardiac rehabilitation programmes. Of these only 61 were supervised by a consultant and only 27 by a cardiologist.

11.2 The physical and psychological effects of myocardial infarction or cardiac surgery are particularly evident in those in whom the disease strikes without warning. Proper counselling by doctors in hospital or by their general practitioners on discharge may do much to allay anxiety and encourage the return to normal activities. Cardiac rehabilitation facilitates this process, both by supervised exercise and by group therapy in meeting with other patients, so that confidence is restored much more quickly. Many studies have shown improved exercise capacity and a quicker return to work in those who have participated in a formal exercise programme than in those who have not.

11.3 In the British Isles, cardiac rehabilitation programmes have a fairly uniform structure with courses beginning two to six weeks after the event and continuing for four to 12 weeks. The usual pattern is graded exercise with some circuit training once or twice a week, supervised by physiotherapists and a nurse or doctor, and with some monitoring of pulse or blood pressure. Spouses are encouraged to attend and there is generally an opportunity for discussion with the dietitian, social worker, or psychologist who attends the sessions.

11.4 The reticence of cardiologists in the United Kingdom to become involved in cardiac rehabilitation is probably attributable to two issues. First, does cardiac rehabilitation do anything to improve prognosis in the long term? The answer to this has always been equivocal because of patient selection and the different types of programme undertaken in different countries. Two recently published meta-analyses, however, do suggest a 20% improvement in prognosis in those who participate in cardiac rehabilitation compared with those who do not.

Secondly, there has been concern about safety. Exercising the patient before the myocardial infarct has fully healed may seem risky, but in practice the incidence of serious or fatal events is very small, probably of the order of one in 100 000 patient attendances. This is probably not very different to the event rate that occurs anyway in the early phases of recovery from myocardial infarction.

11.5 Cardiac rehabilitation should be a service available throughout the country but at present little more than half of patients have access to such facilities. Rehabilitation programmes are not expensive. Although supervision could be undertaken by any physician with the interest and aptitude, a cardiologist would be the most appropriate in that he can best coordinate rehabilitation with exercise testing and the need to assess the patient formally for angiography. A crucial aspect of rehabilitation is the appointment of one person (usually a nurse or physiotherapist) with special responsibility for the programme.

12 Training

12.1 The training programmes for cardiology must take account of the range of skills that are now required—from an interventional cardiologist in a major centre to the cardiovascular physician in a district hospital who may take some responsibility for general medicine. The core of training should be similar. All trainees should acquire expertise in congenital heart disease; knowledge of new developments in cardiac care that include interventional procedures, experience in catheterisation, and coronary angiography; skill in arrhythmia control, pacing techniques, echocardiography, and Doppler; and a sound knowledge of the non-invasive tests undertaken by physiological measurement technicians. They must also take an interest in epidemiology, prevention, resuscitation, and rehabilitation.

12.2 Training in cardiology has always been onerous, but it has become more so with the technological advances of recent decades. Both instruction and experience are necessary, and training must be spread over several years if reasonable confidence is to be attained in the relevant fields within the specialty. At the same time due regard must be paid to a broad knowledge of general medicine. The current recommendations are for a total of at least five years training in cardiology after general professional training plus a year at senior registrar level in general medicine. In addition, those interested in following a career in interventional cardiology would usually require an extra year to acquire the necessary skills and experience. Cardiologists with an academic

interest may well want to spend one or two years in research in addition to the basic requirements for a service commitment. The recommendations are in line with those of the European Community.

12.3 The current recommendations of the Joint Committee on Higher Medical Training for training in paediatric cardiology suggest a flexible programme, normally occupying four years. At least two years should be in a specialist paediatric cardiology centre providing all of the experience that is associated with the supra-regional centres. It is recommended that either during general professional or higher specialist training, 6–12 months should have been spent in adult cardiology and 1–2 years in paediatrics, including six months in a regional neonate unit. A revision of these recommendations has been considered by a Paediatric Cardiology Working Party in order to relate them more closely to those for adult cardiology. The normal training period would then be increased to occupy six years, three at Registrar level and a further three at Senior Registrar level. Ideally one of these years should be spent in research. These recommendations are still under discussion.

13 Academic cardiology and research

13.1 Research has an important part to play in providing quality in medical services. Increasingly, it is being appreciated that the scientific assessment of treatments (as by clinical trials) and medical audit are essential components in the advance of clinical practice. Over and above this, a research experience is a valuable element in the training of physicians, and it is essential that both basic and clinical research of excellence is carried out in British cardiac centres. It has become progressively more difficult to provide opportunities for those who wish to train in research, both because of the lack of career posts in the basic sciences and because the number of honorary posts for clinical research workers is in danger of being severely limited by the quotas determined by the Joint Planning Advisory Committee. The role of research must be taken into account by those planning cardiac services and by those concerned with training.

14 Audit

14.1 At its simplest, medical audit involves peer review of a department or hospital that should encompass all clinical activities including the inpatient and outpatient and diagnostic services, and the operating department. It will review waiting list times as an indirect indication of provision and outpatient waiting times as an index of one aspect of quality of service. It should permit comparisons between hospitals and regions and also differences in national provision.

14.2 National registries on pacemaker implantation and percutaneous cardiac interventional procedures already exist: the British Pacing and Electrophysiology Group has agreed upon guidelines for peripheral pacing clinics, and the Society of Thoracic and Cardiovascular Surgeons has since 1977 published an annual report of cardiac surgical procedures carried out in the United Kingdom.

14.3 A committee, drawn from members of the Cardiology Committee of the Royal College of Physicians and the Council of the British Cardiac Society has been established to initiate and facilitate audit in the specialty. Current projects include audits of the management of acute myocardial infarction, complications from cardiac catheterisation, and proposals for audit of cardiac units in district general hospitals.

14.4 All cardiac departments should cooperate with the audit activities of other specialties in their hospitals, hold regular audit meetings, and maintain appropriate records.

14.5 As with many developments in patient care audit has resource implications with respect both to funding and the availability of clinicians' time. The national registries will be of greatest importance in identifying levels of provision, or its lack, and require to be properly supported.

1 Royal College of Physicians of London and the Royal College of Surgeons of England. Provision of services for the diagnosis and treatment of heart disease in England and Wales. Third Report of the Joint Cardiology Committee. *Br Heart J* 1985;53:477–82.

2 Office of Population Census and Surveys. *Mortality Statistics Series DH1 No 17 Table 24*. London: HMSO, 1987.

3 Office of Population Census and Surveys. *Deaths by Cause 1988 registrations Office of Population Census and Surveys monitor DH2 89/2*. London: HMSO, 1989.

4 Catford JC, Dillon A, Maryon-Davis A, Morris J, Rose GA, Tudor Hart J, *et al.* Coronary Heart Disease Prevention, Action in the UK 1984–1987, National Forum for Coronary Heart Disease Prevention, Health Education Authority. London: 1988.

5 Shaper AG, Cook DG, Walker M, Macfarlane PW. Prevalence of ischaemic heart disease in middle aged British men. *Br Heart J* 1984;51:595–605.

6 Shaper AG, Cook DG, Walker M, Macfarlane PW. Recall of diagnosis by men with ischaemic heart disease. *Br Heart J* 1984;51:606–11.

7 Welsh Heart Programme Directorate. *Heart of Wales: clinical results of the Welsh Heart Health Survey 1985. Heartbeat Report No 20*. Cardiff: Heartbeat Wales, 1987.

8 Office of Population Census and Surveys. *Hospital inpatient enquiry*. HMSO: London, 1986.

9 Sutton GC. Epidemiologic aspects of heart failure. *Am Heart J* 1990;120:1538–40.

10 Somerville J. Congenital heart disease in the adolescent. *Arch Dis Child* 1989;64:771–3.

11 World Health Organisation European Collaborative Group. European collaborative trail of multifactorial prevention of coronary heart disease: final report of the six year results. *Lancet* 1986;19:869–72.

12 British Cardiac Society Working Group. Report on Coronary Disease Prevention, London, British Cardiac Society. London: 1987.

13 King's Fund. *Consensus statement on blood cholesterol measurement in the prevention of coronary heart disease*. London: King's Fund, 1989.

14 Department of Health. *Working for patients*. London: HMSO, 1989.

15 Department of Health. *The GP contract*. London: HMSO, 1989.

16 MacMahon S, Peto R, Cutler J, *et al.* Blood pressure, stroke, and coronary heart disease. *Lancet* 1990;335:765–74.

17 Kannel WB. Update on the role of cigarette smoking in coronary artery disease. *Am Heart J* 1981;101:319–28.

18 Adgey AAJ, Devlin JE, Webb SW, Mulholland HC. Initiation of ventricular fibrillation outside hospital in patients with acute ischaemic heart disease. *Br Heart J* 1982;47: 55–61.

19 Jaggarao NSV, Sless H, Grainger R, Vincent R, Chamberlain DA. Defibrillation at a football stadium: an experiment with Brighton and Hove Albion. *BMJ* 1982; 284:1451.

20 Cobbe SM, Redmond MJ, Hollingworth J, Carrington DJ. Heartstart Scotland: initial experience of a nationwide scheme for out of hospital defibrillation by ambulance crews [abstract]. *Br Heart J* 1990;65:65.

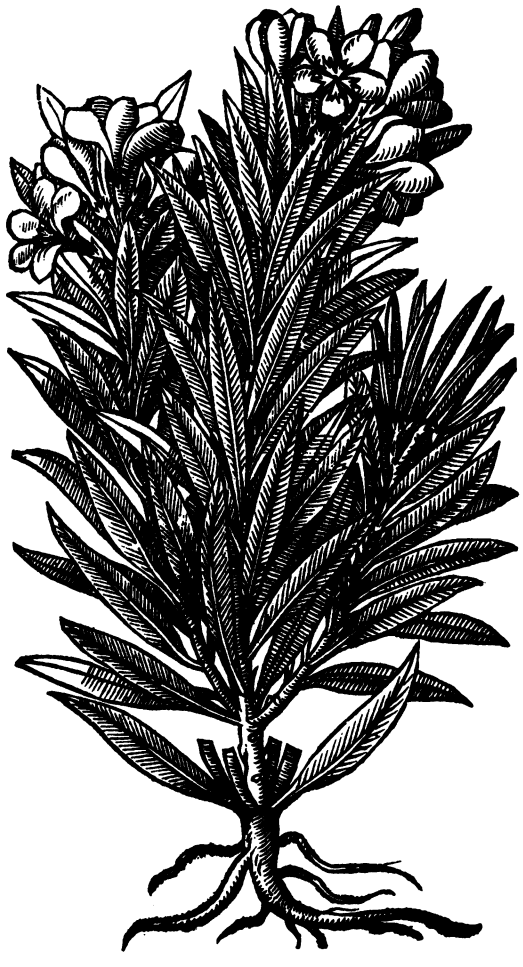
21 Marsden AK, Chamberlain DA. Guidelines for cardiopulmonary resuscitation. *BMJ* 1989;299:442–8.

22 Report of a working group of the British Cardiac Society. Cardiology in the district hospital. *Br Heart J* 1987; 58:537–46.
23 Chamberlain D, Bailey L, Sowton E, Ballantyne D, Boyle DMcC, Oliver M. Staffing in cardiology in the United Kingdom 1988. Fifth biennial survey. *Br Heart J* 1989; 62:482–7.
24 MacRae CA, Keywood C, Marber MS, Joy M. The need for invasive cardiological assessment and intervention: a ten year review. *Br Heart J* 1991 (in press).
25 Hubner PJB on behalf of the British Cardiovascular Intervention Society. Cardiac interventional procedures in the United Kingdom in 1989. *Br Heart J* 1991;66: 467–71.
26 Gray OP, Mann TP, Simpkiss MJ, Joseph MC, Jones RS, Watson GH. Cardiac services for children in England and Wales. Report of a Working Party of the British Paediatric Association and the British Paediatric Cardiology Section. February 1979.
27 Second Report of a Joint Cardiology Committee of the Royal College of Physicians of London and the Royal College of Surgeons of England on combined cardiac centres for investigation and treatment with a note on the requirements of cardiology in hospitals outside such a centre. *Br Heart J* 1980;43:211–9.
28 Report of a joint working party of the British Cardiac Society and the Royal College of Physicians of London. The future of paediatric cardiology in the United Kingdom. *Br Heart J* 1991 (in press).
29 Royal College of Physicians. Report of the Joint Working Group on cardiological interventions in elderly patients. *J R Coll Physicians Lond* 1991;25:197–205.

PLANTS IN CARDIOLOGY

Cardiac glycosides

Foxglove, *Digitalis purpurea* (Scrophulariaceae), was a traditional English folk remedy for dropsy (right heart failure) and its use by an old woman in Shropshire and a carpenter in Oxford led Dr William Withering to undertake his fine scientific study of it from 1775 to 1785. But in spite of his advocacy, its use in dropsy lapsed in the next 100 years though it was used in other diseases such as delirium tremens, epilepsy, and tuberculosis.



Nerium oleander L.
Gerard J. *The Herball.*
London: 1633.

By contrast with its neglect in dropsy, its effect on the heart beat gained emphasis. J-B Bouillaud lauded it in 1835 as "le véritable opium du coeur" and gave it by blistering the precordium and covering the area with powdered digitalis. By 1873 F T Roberts had found that digitalis relieved the pulmonary symptoms of mitral disease "especially when there is great irregularity of the heart". However, it was the work of James Mackenzie, a general practitioner in Lancashire that gave digitalis its established position in the treatment of heart failure. His 10 year analysis of the venous pulse in 500 patients led him in 1902 to identify the arrhythmia later shown to be atrial fibrillation and to show that digitalis was of particular value when ". . . . heart failure was due to the excessive rate of the ventricle, the ventricle being exhausted for want of rest . . . the effect of the drug was at times phenomenal". He recognised what Withering had not—that the relief of dropsy was directly due to the action of the heart.

A cardiac glycoside was first isolated in 1875 when digitoxin was prepared from *D purpurea*. Soon afterwards ouabain and strophantin-K were isolated from the African trees *Acokanthera* and *Strophanthus* which were used as arrow poisons. American pioneers learnt from the Indians that *Apocynum*, dogbane, was a diuretic and it became known as the vegetable lancet because it worked as well as venesection. These three genera belong to the family Apocynaceae which has six other members containing glycosides and also includes the genera yielding resperine and the vinca alkaloids. Altogether in twelve plant families there are 37 genera with glycosides. One of these is the plant used longest as a diuretic, *Drimia maritima* (squill), which is mentioned in the Ebers papyrus of 1500 BC.

I sometimes wonder whether the eminence of digitalis has inhibited a thorough evaluation of the other glycosides such as the powerful oleandrin found in *Nerium oleander* (*British Heart Journal* 1985;54:258–61).

A HOLLMAN